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PHILIPPINE ZOOLOGICAL EXPEDITION

1946–1947

STONEFLIES FROM THE PHILIPPINES (PLECOPTERA)

STANLEY G. JEWETT, JR.

Among the insects collected by the Philippine Zoological Expedition, 1946–47 (Hoogstraal, 1951), are a number of well-preserved Plecoptera, nymphs as well as adults. For the most part these were taken on the island of Mindanao; a few are from Palawan. The material includes nine species, one of which I have described as new. I have included descriptions of two nymphs which are of particular interest because they represent distinct phylogenetic lines apparently confined to Asia.

A large number of names have been applied to neoperline stoneflies from southeastern Asia. Many of these may eventually be synonymized. A detailed study of material from the East Indies and the mainland of southeastern Asia should be made to determine the exact number of species; a number of them may occupy a wide geographic range, including the Philippines. Klapalek (1921), Navas (1918), and Banks (1913, 1920, 1924, 1937) have described neoperlines from the Philippines. While it has not been possible for me to examine the types of species described from the Philippines I feel that it is reasonably correct to associate some of Banks' names with material contained in this collection.

I have followed Kimmins (1950) in regarding *Phanoperla* Banks (1938) as a genus distinct from *Neoperla*, because of the distinctive venation and male genitalia. I regard *Rhopalopsole* Klapalek (1912) as a subgenus of *Leuctra*, since it has venation almost identical with the subgenus *Paraleuctra* Hanson (1941), and its prosternal sclerotization is like that of the subgenus *Zealeuctra* Ricker (1952); its peculiar

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male genitalia furnish sufficient reason for regarding it as a distinct subgenus.

The material listed in this paper is in the collection of Chicago Natural History Museum unless otherwise designated, as follows: USNM (United States National Museum), MCZ (Museum of Comparative Zoology), and SGJ (the writer).

I am indebted to Dr. P. J. Darlington, Jr., Museum of Comparative Zoology, through whose courtesy I was able to examine two specimens of *Leuctra* (*Rhopalopsole*) *malayana* Banks, including the male type; to Dr. J. F. Gates Clarke, United States National Museum, for the loan of the Philippine stonefly material under his care, most of which was studied by Banks; and to Dr. Clifford C. Gregg, Director of Chicago Natural History Museum.

Family PELTOPERLIDAE

Peltoperla mindanensis Banks. Figure 17.

Peltoperla mindanensis Banks, 1924, Bull. Mus. Comp. Zool., **65**: 426, pl. 2, fig. 20.

The male genitalia of this species (fig. 17, A) are notable for the median lobe on the anterior median border of the ninth sternite. The female subgenital plate (not figured), a large produced lobe extending over the ninth sternite and evenly rounded, is typical for the genus. Teneral specimens have remnants of the thoracic gills, but these are absent in fully hardened adults.

Nymph (nearly mature): Length of body 10 mm. Body brown, covered with fine, appressed hairs, somewhat less roach-like in general aspect than *Peltoperla brevis* Banks. Single, slender, finger-like external gills present as follows: under each side of sternal plates of prothorax and mesothorax at base of legs, under each side of dorsal plates of mesothorax and metathorax, and on each subanal lobe (fig. 17, C). Stout spines or bristles distributed as follows: as a border on margins of sternal plates, that of anterior margin of prosternal plate longest and most conspicuous; as a fringe around hind margin of each abdominal segment and each cercal segment; on subanal lobes; on outer margin of coxae; scattered on outer face of femur and as a terminal band; scattered on tibia and as a terminal band. There is a row of fine, long hairs on outer margins of each femur and tibia, those on tibia longest. Each femur deeply grooved below to hold tibia when folded; each femur and tibia compressed vertically to lie close to sides of thorax. Each sternum of thorax with a plate overlapping backward (fig. 17, B). Cercal segments normal, well over 25 in number.

Galea reaching lacinia, with a tuft of hairs at the tip (fig. 17, D); lacinia with two spines at tip and an inner spine; paraglossae exceeding glossae, both with tuft of hairs at tip; mandibles with several wedge-shaped teeth.

Until more is known about the nymphal morphology of Asiatic peltoperlines, it seems best not to attempt to assign this species to a subgenus.

Material examined.—MINDANAO: Todaya, Mount Apo (east slope; 2,800 ft. alt.); 22 N, 2 ♂, 5 ♀ (10 N, 1 ♂, 2 ♀, SGJ); on rocks in and along the Sibulan River; Oct. 27–Nov. 20, 1946; D. Heyneman and G. Alcasid.

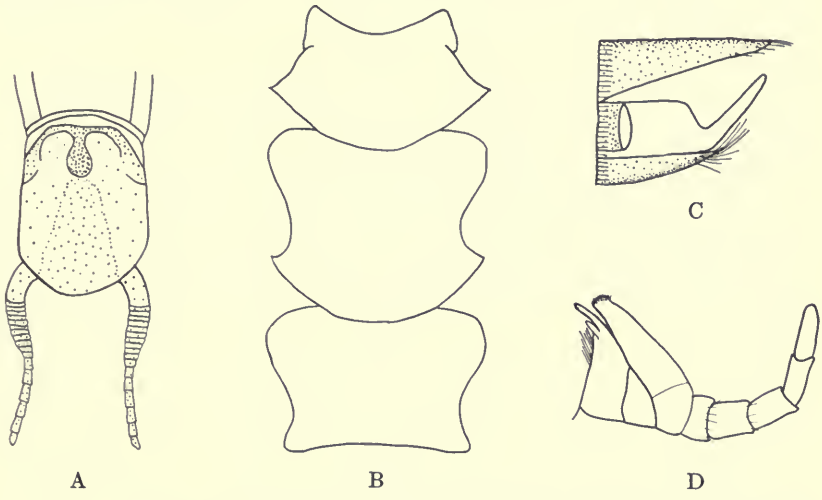

FIG. 17. *Peltoperla mindanensis:* A, male genitalia, ventral view; B, nymphal sternal plates; C, right anal gill of nymph; D, left maxilla of nymph.

Camp Meran, Mount Apo (east slope); 1 ♀; "along a swift stream;" Nov. 6, 1946; H. Hoogstraal.

Mount McKinley (east slope; 3,000–3,300 ft. alt.); 1 N (small), 1 ♀; on rocks in creek and along stream; Aug. 12–29, 1946; H. Hoogstraal and F. G. Werner.

Bugasan-Parang, Cotabato Province; 1 ♂ (SGJ); at light; Dec. 12, 1946; F. G. Werner.

Surigao; 1 ♂ (USNM); C. F. Baker.

Family **NEMOURIDAE**

Subfamily **Leuctrinae**

Leuctra (Rhopalopsole) malayana Banks. Figure 18.

Leuctra malayana Banks, 1920, Bull. Mus. Comp. Zool., **64**, (3), p. 325, pl. 4, fig. 45.

The following descriptions are based on material from Mindanao. The male type of this species and a female bearing an identical locality label, "Imugin, N. Viscaya," were kindly lent to me. These two pinned specimens were partially relaxed, examined, and found to be virtually identical with the Mindanao material. The furcate tips of the lateral prongs of the male genitalia in the type are more prominent than in the male from Mindanao but are similarly shaped; the female from Imugin has a subgenital plate that appears to be identical with that of the Mindanao females.

Nymph (mature): Length of body 8.5 mm. Entire body (fig. 18, C) yellow brown, mature wing pads nearly black. Head rounded; antennae slender, straight, without hairs. Ocelli translucent, almost invisible. Dark marks present in front of anterior ocellus (absent in immature nymphs).

Presternum and basisternum separated by a groove. Entire body without hairs. Each cercal segment with a distal whorl of long bristles.

Galea exceeding lacinia (fig. 18, D), without hairs; lacinia with fringes of hairs on both upper and lower margins; labium typical; mandibles with several heavy teeth and basal to these a blade whose outer half is margined by a row of stiff setae (fig. 18, E).

Adult: Length to wing tips: male 10 mm., female 8.5–12 mm. Length of body: male 8 mm., female 7–10 mm. Body brown, wings slightly fumose. Venation typical for subgenus, with no fork in Cu_1 of hind wing beyond vein cu-m. Presternum completely separated from basisternum.

Male: Dorsal processes absent from abdominal segments. Ninth and tenth segments and their appendages heavily sclerotized; a median area on ninth tergite somewhat membranous. Other abdominal segments largely membranous, with sclerotized areas on anterior borders of the tergites except in the wholly membranous median quarter of each. Anterior border of ninth sternite bears a hairy median lobe, beneath which is a clear area (fig. 18, B); the lobe protrudes out from the sternite at an angle of about 45 degrees. The ventral distal sclerite on the ninth sternite ends in a rounded, median lobe which is membranous at its tip. The posterior median portion of the tenth tergite is formed into a small, recurved, sclerotized, dorsal hook (fig. 18, A). Lateral portions of the tenth tergite are greatly enlarged and drawn out distally to form furcate prongs. Cerci beset with hairs; cerci arise from lateral base of tenth tergite. Hairs on eighth sternite longer and more dense than those on seventh and ninth sternites.

Female: Subgenital plate on seventh sternite slightly produced, rounded, translucent medially at its tip (fig. 18, F); what appears to be a rounded notch at its tip is the sclerotized genital opening. Eighth sternite unmodified.

Material examined.—MINDANAO: Lake Linau, Mount Apo (north slope; 7,900 ft. alt.); 16 N, 1 ♂, 3 ♀ (6 N, 1 ♂, 1 ♀, SGJ); in mossy forest, and in flight over stream through tall grass; Oct. 25–Nov. 2, 1946; H. Hoogstraal and F. G. Werner.

Burungkôt, Upi, Cotabato Province (1,500 ft. alt.); 1 ♀ (SGJ); at light; Jan. 1, 1947; F. G. Werner.

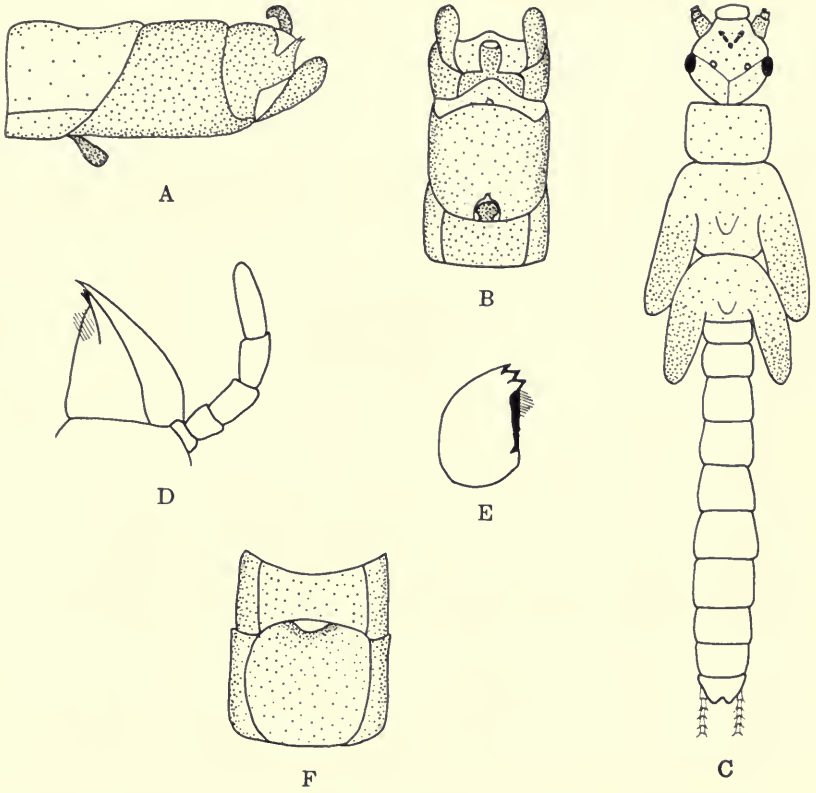

FIG. 18. *Leuctra* (*Rhopalopsole*) *malayana:* A, male genitalia, lateral view; B, male genitalia, ventral view; C, outline of nymph; D, left maxilla of nymph; E, left mandible of nymph; F, female genitalia, ventral view.

Crater Lake, Mount Apo (9,000 ft. alt.); 1 ♀; Nov. 15, 1946; H. Hoogstraal.

LUZON: Imugin, northern Viscaya; 1 ♂ (type, MCZ), 1 ♀ (MCZ); C. F. Baker.

Leuctra (Rhopalopsole) palawana, new species. Figure 19.

Holotype.—A female, south slope of Mount Balabag, Mantalingajan Range, southern Palawan Island, Philippine Islands, May 4, 1947; F. G. Werner. In the collection of Chicago Natural History Museum.

The shape of the subgenital plate and the sclerotized areas on the eighth sternite serve to distinguish this species from *L. mala-*

yana Banks, the only other described species of *Leuctra* from the Philippine Islands.

Female: Length to tip of wings 8.5 mm., to end of body 7 mm. In general appearance very similar to *L. malayana*, described above. The distal portion of the subgenital plate is produced and slightly rounded; eighth sternite sclerotized as in figure 19.

Family **PERLIDAE**

Subfamily **Perlinae**

Genus **Neoperla** Needham

Pseudoperla Banks, 1892, Trans. Am. Ent. Soc., **19**: 322 (not Pictet, 1854, Traité Pal., **2**, ed. 2, p. 364).

Neoperla Needham, 1905, Proc. Biol. Soc. Washington, **18**: 108.

The separation of Asiatic species in this genus is very difficult because of wide variation in morphological characters in many of the species and because most of the present descriptions do not include sufficient details, particularly of male genitalia, to separate them. While the size and location of the eyes and ocelli are quite variable, these structures aid in separating the species when correlated with general head shape and the morphology of the rear median area of the head. It is particularly desirable to preserve fresh material of this genus in alcohol to preserve color patterns and to avoid the distortion which occurs when specimens are dried.

Four distinct species are present in the material taken by the expedition. Additional material from Mindanao and Luzon (borrowed from the United States National Museum) includes the same four species. It is of interest to note that two of these species occur on both islands. It is quite possible that some or all of the species occur in parts of southeastern Asia. The male genitalia of the four species closely resemble those of *Neoperla clymene* (Newman), the type species of the genus, in general pattern; each has a prominent process on the seventh tergite, and a process is also present on the eighth tergite of *N. recta* Banks. The female sternites are apparently unmodified in all four species. Names proposed by Banks have been applied to this material, but until Banks' types can be critically studied there will be some uncertainty as to the correctness of these assignments.

Neoperla atripennis Banks. Figure 20.

Neoperla (*Javanita*) *atripennis* Banks, 1924, Bull. Mus. Comp. Zool., **65**, (12), p. 428, pl. 2, fig. 21.

The dark wings and body and bicolored legs distinguish this species. Banks' illustration of the male genitalia is fairly accurate, though what appears to be a plate on the eighth tergite is only a dark sclerotized area. The head bears rather small eyes and ocelli (fig. 20).

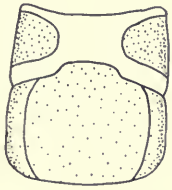

FIG. 19. *Leuctra (Rhopalopsole) palawana*, female genitalia of holotype, ventral view.

FIG. 20. *Neoperla atripennis*, female head and prothorax.

Banks erred in placing this species in the subgenus *Javanita*. The "last ventral segment" of the male is not "pointed in the middle," though Banks may have been led to this conclusion by distortion of his specimen in drying. This species is related to the other Philippine members of the genus. The male forewing measures about 11 mm. in length, that of the female 16 mm.

Material examined.—MINDANAO: Mount McKinley (east slope; 3,000 ft. alt.), Davao Province; 1 ♀; Aug. 29, 1946; F. G. Werner. Surigao; 2 ♂ (USNM); C. F. Baker.

Neoperla obliqua Banks. Figure 21.

Neoperla obliqua Banks, 1913, Proc. Ent. Soc. Washington, **15**: 172, pl. 8, fig. 12.

The oblique crossvein between the radial sector and the radius seems always to be present in the forewing (occasionally distinct only in one wing). The apical portion of the wings is without crossveins. Figure 21 illustrates the head pattern. The male genitalia do not include a process on the eighth tergite but are otherwise similar to those of *N. recta* Banks. The male forewing measures 14–17 mm. in length, that of the female 15–23 mm.

Material examined.—MINDANAO: Mount McKinley (east slope; 3,000–5,200 ft. alt.); 17 ♂, 10 ♀ (7 ♂, 3 ♀, SGJ); in mossy and

open forests and on rocks in stream; Aug. 21–Oct. 20, 1946; H. Hoogstraal and F. G. Werner.

Mount Apo (east slope); alt. 2,800 ft. (Todaya), 4,300 ft. (Camp Mainit), 6,000 ft. (Camp Meran); 5 ♂, 54 ♀ (1 ♂, 15 ♀, SGJ); Nov., 1946; H. Hoogstraal and G. Alcasid.

FIG. 21. *Neoperla obliqua*, male head and prothorax.

FIG. 22. *Neoperla oculata*, female head and prothorax.

Galog River, Mount Apo (6,000 ft. alt.); 1 ♀ (USNM, labeled "Paratype *N. apoana*"); Oct. 18; C. F. Baker.

Burungkôt, Upi, Cotabato Province (1,500 ft. alt.); 2 ♀ (1 ♀, SGJ), at light; Dec. 31, 1946–Jan. 1, 1947; F. G. Werner.

Tangcolan, Bukidnon Province; 1 ♀ (USNM); C. F. Baker.

Agusan, Bukidnon Province (1,000 ft. alt.); 1 ♀, July 26, 1946; H. Hoogstraal and D. Heyneman.

LUZON: Mount Makiling; 1 ♂, 2 ♀ (USNM); C. F. Baker.

Neoperla oculata Banks. Figure 22.

Neoperla oculata Banks, 1924, Bull. Mus. Comp. Zool., **65**: 428, pl. 2, fig. 16.

The shape of the head, especially the visible suture lines behind the ocelli, and the very large eyes separate this species (fig. 22). The male genitalia are very similar to those of *N. recta*. As in *N. obliqua* the crossvein between the radial sector and radius is slanted obliquely inward. The third segment of the maxillary palpus is noticeably curved inward, differing in this respect from the other species of *Neoperla* treated in this paper. This is also the smallest of the species studied. The length of the forewing of the male is about 11 mm., that of the female 12–14 mm.

Material examined.—MINDANAO: Badiang Tagabuli, Santa Cruz, Davao Province (2,000 ft. alt.); 16 ♀ (6 ♀, SGJ); at light; Dec. 10, 1946; M. Celestino.

Maco, Tagum, Davao Province (near sea level); 7 ♀ (2 ♀, SGJ); at light, in original forest (3 ♀, at Sitio Taglawig, near Maco); Oct. 7–15, 1946; H. Hoogstraal.

Surigao; 2 ♂ (USNM); C. F. Baker.

Neoperla recta Banks

Neoperla recta Banks, 1913, Proc. Ent. Soc. Washington, **15**: 172, pl. 8, fig. 10; 1937, Philipp. Jour. Sci., **63**: 135.

This species is readily distinguished by the straight crossvein between the radial sector and radius and by the crossveins in the apical part of the forewings. In the male there is also a prominent process on the eighth tergite as well as one on the seventh tergite. The eyes are somewhat more prominent than those of *N. obliqua* Banks. The shape and morphology of the rear median area are very similar to those of *N. obliqua*. The length of the male forewing is 13–20 mm., that of the female 16 mm. (from Luzon only). Specimens from Luzon are much smaller than those from Mindanao.

Material examined.—MINDANAO: Camp Meran, Mount Apo (east slope; 6,000 ft. alt.); 4 ♂ (2 ♂, SGJ); "rocks in swift stream;" Nov. 6, 1946; H. Hoogstraal.

LUZON: Los Baños; 1 ♂ (USNM); C. F. Baker.

Mount Makiling; 3 ♂, 1 ♀ (USNM); C. F. Baker.

Imugin, northern Viscaya; 1 ♀ (USNM); C. F. Baker.

Genus **Phanoperla** Banks

Phanoperla Banks, 1938, Jour. Fed. Malay States Mus., **18**: 221.

There are at least two species of this genus in the Philippines. They are separable on the basis of the male genitalia and to some extent on the distance between the ocelli. The wing venation of the two cannot be differentiated. In both, the origin of Cu_2 is usually slightly ahead of the first cubito-medial crossvein, but sometimes it is at or slightly behind it. The rear median portion of the head appears to be identical in the two species.

Phanoperla bakeri (Banks). Figure 23.

Neoperla bakeri Banks, 1924, Bull. Mus. Comp. Zool., **65**: 426–427, pl. 2, fig. 19.

Figure 23 shows the male genitalia of what is considered to be *P. bakeri*. Banks' illustration, cited above, is closer to what I consider to be his *N. clarissa*. Specimens examined match neither his written description nor his illustration; possibly the legends for his

figures 15 (*N. consimilis* Banks) and 19 were transposed. In specimens identified as *P. bakeri* the anterior point on the male genital hook is always rounded, and there is one large depressed patch of spicules on the ninth tergite. In the male the ocelli are rather widely separated. The male forewing measures 10–14 mm., that of the

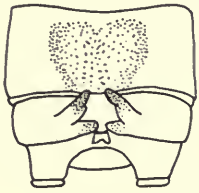

FIG. 23. *Phanoperla bakeri*, male genitalia, dorsal view.

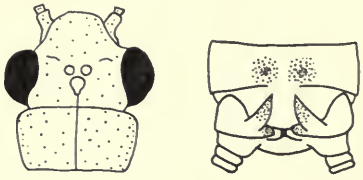

FIG. 24. *Phanoperla clarissa:* A, male head and prothorax; B, male genitalia, dorsal view.

female 16 mm. The males from Luzon are smaller than those from Mindanao.

Material examined.—MINDANAO: Mount McKinley (east slope; 6,400 ft. alt.); 1 ♂; in mossy forest; Sept. 7, 1946; H. Hoogstraal.

Mount Apo (east slope; alt. 4,300 ft., Camp Mainit; 6,000 ft., Camp Meran); 1 ♂, 2 ♀ (1 ♂, 1 ♀, SGJ); on rocks in swift stream, and at light; Nov., 1946; H. Hoogstraal.

LUZON: Mount Makiling; 3 ♂ (USNM); C. F. Baker.

Phanoperla clarissa (Banks). Figure 24.

Ochthopetina clarissa Banks, 1913, Trans. Amer. Ent. Soc., **39**: 204.

The ocelli seem to be consistently closer together in this species, especially in the male, than in *P. bakeri*, and the anterior tips of the male genital hooks are pointed (fig. 24). Spicules on the ninth tergite of the male are arranged in two elevated patches, not in a single depressed patch as in *P. bakeri*. This species is of the same general size as *P. bakeri*, and material from Mindanao is somewhat larger than that from Luzon.

Material examined.—PALAWAN: Bacungan, near Puerto Princesa (near sea level); 1 ♂ (SGJ); "near small rocky stream;" Mar. 26, 1947; F. G. Werner.

BUSUANGA (Calamianes Island group): Dimaniang (near sea level); 1 ♂; "on shrub leaf over creek;" Mar. 14, 1947; H. Hoogstraal.

MINDANAO: Burungkôt, Upi, Cotabato Province (alt. 1,500 ft.); 1 ♂ (SGJ); at light; Jan. 1, 1947; F. G. Werner.

Sitio Taglawig, near Maco, Tagum (near sea level); 1 ♂; "at light in forest;" Oct. 11, 1946; H. Hoogstraal.

Dansalan, Lanao; 1 ♂, 1 ♀; May 16, 1946; H. Hoogstraal.

Kolombugan; 1 ♂ (USNM); C. F. Baker.

Surigao; 1 ♂ (USNM); C. F. Baker.

LUZON: Mount Makiling; 2 ♂, 1 ♀ (USNM); C. F. Baker.

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